PATENT COOPERATION TREATY

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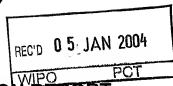WIPO   PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 1351827-0137	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/CA02/00786	International filing date *(day/month/year)* 28/05/2002	Priority date *(day/month/year)* 30/05/2001
International Patent Classification (IPC) or national classification and IPC H04L12/56		

Applicant MOSAID TECHNOLOGIES INCORPORATED et al.

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

       I   ☒   Basis of the report

       II   ☐   Priority

       III   ☐   Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

       IV   ☐   Lack of unity of invention

       V   ☒   Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement

       VI   ☐   Certain documents cited

       VII   ☐   Certain defects in the international application

       VIII ☐   Certain observations on the international application

Date of submission of the demand 30/12/2002	Date of completion of this report 30.12.2003

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preliminary examining authority:
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I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)):*
   Description, pages:

1-13	as originally filed

   Claims, No.:

1-20	as originally filed

   Drawings, sheets:

1/6-6/6	as originally filed

2. With regard to the **language,** all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description,   pages:

   ☐ the claims,   Nos.:

☐   the drawings, ------ sheets:

5. ☐   This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-20
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations
    see separate sheet

With respect to item V:

1   Prior art

Reference is made to the following documents:

D1:   WO 99 13619 A (SICS SWEDISH INST OF COMPUTER ;SJOEDIN PETER
(SE); MOESTEDT ANDREA) 18 March 1999 (1999-03-18)

D2:   GUPTA P ET AL: 'Routing lookups in hardware at memory access speeds'
INFOCOM '98. SEVENTEENTH ANNUAL JOINT CONFERENCE OF THE
IEEE COMPUTER AND COMMUNICATIONS SOCIETIES. PROCEEDINGS.
IEEE SAN FRANCISCO, CA, USA 29 MARCH-2 APRIL 1998, NEW YORK,
NY, USA,IEEE, US, 29 March 1998 (1998-03-29), pages 1240-1247,
XP010270370 ISBN: 0-7803-4383-2

The invention relates to a multi-level lookup table for looking up a route associated
with given IP address (independent claims 1 and 15) and a corresponding method
(independent claim 7). A multi-level lookup table comprising a plurality of memo-
ries, a binary tree representation of a routing table mapped into the memories,
with each memory associated with one level of the binary tree is known from
document **D1.** By storing the routing table into separate memories for each level,
pipelining of routing table searches can be done, i.e. simultaneous access to the
routing table is possible.

A problem associated with a prior art lookup table is that some of the levels of the
binary tree may be sparsely populated and other levels may be densely populated
resulting in an uneven distribution of routes stored in the table. Some of the fixed
size memories associated to a densely populated level are therefore full, some
memories associated to sparsely populated levels are not fully used. If subtrees
stored in a memory of a certain level are moved to memory of a lower level of the
routing tree, memory access conflicts can occur if parallel searches are accessing
the same level. This problem has already been discovered and formulated in
document **D2** (page 1241, left-hand column, lines 23-28).

2 **Object**

It is therefore an object of the invention to provide a multi-level lookup table wherein the memories can be used more efficiently and wherein parallel searches are possible.

3 **Solution**

This is achieved by a lookup table having a plurality of memories associated to levels of the routing tree and adapted to store a subtree associated with a densely populated level of the tree in a memory of a level lower than the densely populated level.

In contradiction to the requirements of Article 6 PCT taken in combination with Rule 6.3(b) PCT, the following further essential features are currently not included within the independent claims:

- the multi-level lookup table is further adapted to select a subtree not including any subtree pointers (page 8, lines 12-14 of the description); and

- to store a skip indicator with a subtree index to the subtree in a memory associated with a higher level of the binary tree indicating that the subtree of the densely populated level is stored in a memory associated with a lower level (page 5, lines 19-23 of the description).

4 **Conclusions**

The inventive concept (including the essential features mentioned above) is neither disclosed nor rendered obvious by the prior art at hand. Independent **claims 1, 7 and 15** would therefore meet the requirements of Article 33 PCT with regard to novelty and inventive step provided that the essential features are included. By storing subtrees not including any subtree pointers in a lower level of the table and skipping an intermediate level, memory access conflicts for parallel searches are avoided.

5   Further considerations

5.1   The application includes 2 independent apparatus claims **(claims 1 and 15)** with the same subject-matter and dependent claims having many additional features in common. The claims as a whole do therefore not meet the requirements of Article 6 (conciseness) and Rule 6.1(a) PCT (reasonable number of claims).

5.2   The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

5.3   Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D1 is not mentioned in the description, nor is this document identified therein.

5.4   The independent claims are not in the two-part form as required by Rule 6.3(b) PCT, with those features which in combination are part of the prior art being placed in the preamble. A multi-level lookup table comprising a plurality of memories, a binary tree representation of a routing table mapped into the memories, with each memory associated with one level of the binary tree is already known from document **D1**.